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2 Mod. ope. of Acet. of Lead.
3 arsenic –
4 arsenic –
5 arsenic –
6. animal poisons –
7 Nitrat of Bismuth –

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An Experimental Essay on the Prussiate of Potash

Prussiate

1814

by D Burwell –

Dudley Burwell 1814

It may not be amiss to give the process by which I prepared the prussiate of Potass. I made it in the following manner; I first made a strong alkaline solution, which, after being filtered was put in an iron pot & exposed to a sufficient degree of heat to produce ebulition; & while in that state the Prussiate of Iron finely powdered was added as long as the alkaline solution was capable of destroying its colour. It was then taken off the fire & filtered after which it was put into a glass vessel & exposed to a gentle heat until a pelicle formed on the surface of the fluid it was then removed from the fire & set aside to crystallize.

Doctor Cope —

D. Sir,

I called this afternoon to see you but not finding you at home I left my Essay on the Prussiate of Potash. I am extremely sorry that various circumstances prevented me from prosecuting the subject to the extent you wished. So many obsticles opposed themselves, that I was forced at present to abandon the idea altogether. I have taken the liberty of keeping the original Essay, merely because the copy is much more neatly written, & I flatter myself it will meet with your approbation. It is a faithful copy of the original, excepting a few alterations which you suggested, together with the addition of the mode I made use of in preparing the P. Potash. I remain yours &c

April 7th 1814 — D. Bunnell

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Introduction

No inducement whatever at this time would make me attempt an Essay on any subject, were it not rendered indispensible by the Laws & Customs of this University. From the peculiar situation of those who are subjected to the influence of the Laws relative to Graduation, it follows as a necessary consequence, that any production of theirs, must be either trite or imperfect. Possessed of little or no experience of their own, they are constrained to follow the footsteps of others, which are often incorrect & very generally questionable. I do not mean to assert that no confidence ought to be placed in Medical Writers, but merely to observe, that they are particularly liable to err, both from the difficulties of the subjects which they treat of, and from the delusion of preconcieved opinions. Obstacles inherent

Introduction.

in the subject are only one source of the inaccuracies to be found in Medical Authors. There is another cause still more baneful in its influence, & to which many of the false observations to be met with manifestly owe their origin. I mean that predisposition to theorize which unfortunately for the Science has insinuated itself into most of the productions of Physicians. Far be it from me to abolish altogether principles in Medicine - When founded on facts they are not only important towards practising the art with success, but serve the additional purpose of arranging the facts belonging to any science in that clear & perspicuous order so necessary to facilitate ~~the~~ its improvement. - Unfortunately however for the Science & Mankind in general, most of the theories of the present day are the effusions of fancy, rather than the deductions of reason. Instead of being conclusions drawn from well authenticated facts, they are too often formed in the imagination of the author; facts are next sought for to support them amid the

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resources of Reverie, & if they are wanting every faculty of the mind is employed to invent plausible arguments which may serve to delude: For the appearance of Truth is sufficient to secure the approbation of most men, the majority being always more disposed to close with statements, than endure the trouble of scrutinizing their merits.—

Since then the improvement of every Science in order to be permanent depends upon the developement of new facts, the necessity of Experimental Enquiry as the surest guide to truth must be apparent to the most superficial observer. It is impossible for fallacy to exist in conclusions drawn from experiments, provided they are conducted with care and precision. Hence the universal assent of mankind to doctrines founded on facts elicited by experiment. Such is my confidence in the unrivalled efficacy of this mode of investigation, in accellerating the progress of any Science, that I have ventured upon an

essay of that nature. Tho' deeply sensible of my inadequacy to render it the justice which it merits, I will not relinquish the hope that my good intentions will at least be an apology for the imperfections it may contain. — It was my original intention merely to repeat the experiments of Mr Wallaston on the Prussiate of Potash; but finding that the article exerted very considerable influence on my pulse, I concluded that it would be interesting & perhaps useful (in connection with my other experiments) to observe its effects upon the System generally. Before entering directly upon the proper subject of this essay, I think it necessary to explain with what view Mr Wallaston first instituted his experiments. In order to ascertain whether the blood of Diabetic patients contained any Saccharine matter in its composition Mr Wallaston instituted a Series of Experiments on the blood of persons discharging daily large quantities of sugar in their Urine — not the smallest portion of the substance

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was detected. From the result of these experiments he concludes that the saccharine matter found in Diabetic Urine is formed in the Stomach & conveyed directly from that viscus to the Kidnies without entering into the general circulation. – To confirm the above conclusions the same Gentleman in conjunction with Mr. Marset performed a number of experiments on the Prussiate Potass. The point in view was, whether it could be detected when taken internally, in the blood or the secretions. – After experimenting several times with the article above mentioned, they concluded that it was not absorbed into the general circulation, but carried from the Stomach to the kidnies by some unknown vessels. – Not having it in my power to perform the first set of experiments made on Diabetic patients, I determined to repeat those on the Prussiate Potass. with the view of ascertaining whether Messrs. Wallaston & Marset were warranted in the conclusions contained in their paper

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before the Royal Society of London. Although my experiments are not as conclusive as they might be with sufficient time to push them to a greater extent, yet I am convinced from the results afforded that this substance is taken into the general circulation. In two experiments I detected it as distinctly as the quantity of the substance which was taken would permit. It was my intention to have varied my experiments on a number of inferior animals, but unfortunately the press of time, & the difficulty of procuring the proper ones, prevented me from pursuing the subject to the extent which I contemplated.

As this essay will embrace subjects of a different nature, it will be necessary to divide it into two parts or sections — the first relating to the absorption of the Prussi: Potass into the general circulation — the second comprehending its general effects on the system when taken into the stomach.

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without further delay give as concise an account as possible of those experiments which I made appertaining to the absorption of the Prussiate Potash into the general circulation & afterwards make some observations on the results.—

Expt. 1st. At half past 9 O'clock I took 2 grs of the Prussiate of Potash in solution — in one hour after I took 3 grs & at the end of 2 hours after taking the first dose I took an additional quantity of 3 grs making the whole of the substance that I had taken at the expiration of two hours amount to 8 grs. Upon examining my urine 3 hours & a half after taking the first dose of the article, I found by adding a small portion of the solution of Iron, that a slight blue tinge was produced in it. — In half an hour afterwards, being 4 hours from the commencement of the experiment, I repeated it on a quantity of urine and found by the addition of Sulphate of Iron in solution, a very considerable precipitate of a blue

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colour to fall to the bottom of the vessel, shewing distinctly the presence of the Prussic acid in the urine. I then had myself bled, for the purpose of ascertaining whether I could detect its presence in the serum of the blood. — On the following day when the serum had seperated from the other parts of the blood, I presented a small portion of the solution of Iron to it & distinctly perceived a blue colour to ensue, proving beyond all doubt the presence of the Prussic acid. — Several of my friends were present, among them Messrs Marshall & Son Britton who fully coincide with me in opinion

Expt — 2d — In the course of three hours I took in divided doses 10 grs of Pruss: Potash — Upon examining my Urine three hours & a half after taking the first dose I detected the presence of the Prussic acid in a slight degree; half an hour after, its existence was very manifest. At this time I had myself bled, & found by adding a portion of Sulph: of Iron in solution to

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the Serum, the same result as in the preceding experiment, tho' not so strongly marked — I then added a sufficient quantity of sulphuric acid to coagulate the Serum by which the blue colour was rendered much more apparent

Expt 3d — In two hours & a half I took 8 grs of the article in solution, & in four hours its presence in the urine was readily detected. At this period I submitted again to venesection; but on trial of the abovementioned test the presence of the Prussic acid was not perceptible. This circumstance I ascribed to the Serum having been agitated & consequently rendered turbid, thus being insusceptible of the change of colour on the exhibition of the proper test. — From the result of the above experiments I hold myself warranted in withholding my assent to the inferences of Messrs Wallaston & Marsset. I feel thoroughly satisfied that the Prussic acid is taken up by the lacteals into the general

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circulation, & conveyed by this route to the Kidnies, through which organs it is eliminated from the system. Even allowing for a moment that its presence cannot be detected in the serum of the blood, how can we explain its existence in the urine? The chain of vessels on which Mr Wallaston has devolved this function, rests on grounds too imaginary & fallacious to warrant a conviction of their reality. It is certain that they have never yet been discovered either by injection or the aid of microscopic investigation though employed by Anatomists renowned for the keenest discernment & unremitting industry. This circumstance alone is sufficient to prove that their alledged existence is wholly unfounded. As its presence in the urine is susceptible of the most conclusive demonstration, the inability to detect it in the blood if such is the fact, may with more reason be ascribed to the imperfect state of Chymical knowledge than to its actual absence.

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Who has ever been able to discover the specific differences between Marsh-miasmata & common atmospheric air, & yet mankind are universally agreed that their properties are essentially distinct. All that is known on the subject is derived from observation directed to their effects on the System, by which it is incontestibly proven that the one is endued with some peculiar property to which its noxious effects are referable – Although ignorant of the nature of this agency, we are nevertheless fully assured of its existence. It is very well known that the Mur: of Mercury may be given in solution so much divided as to produce the desired impression on the system, without our being able by any known chymical test to ascertain its presence. this circumstance is sufficiently strong to point out the necessity of deliberate caution in drawing conclusions from such premises. From the above mentioned experiments I am thoroughly con-

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With respect to the seat of the disease called Diabetes I coincide with Mr Wallaston in supposing that it is purely a disease of the Stomach. I am led to this opinion 1st From its often attending other diseases of that viscus such as Hysteria, Hypochondriasis & Dyspepsia. 2d From the voracious appetite, indigestion & costiveness which almost invariably attend this complaint 3d From its general occurrence in those whose constitutions have been shattered by intemperance in drinking and other excesses, the effects of which are primarily exerted on the Stomach. In addition to the arguments derived from the disease itself, we have the observations of several Practitioners of the highest eminence, which prove beyond all doubt that the blood of Diabetic Patients contains su=

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gar in its composition. From the experiments of Dr Dobson we learn that he detected sugar in the blood of persons labouring under Diabetes. The authority of this gentleman alone would be sufficient to give unquestionable validity to the fact were it not supported by the observations of others of equal respectability & weight. I allude to the observations of Dr Rollo & Mr Cruikshank – these gentlemen are fully persuaded that they ascertained the presence of sugar in Diabetic blood by tasting the serum, which evidently imparted a sweet taste. I am extremely happy that I am in possession of a fact from a source entitled to the highest credit, which goes directly to confirm the above opinion – the fact was communicated to me by Professor Barton, whose talent for close & correct observation is already known & justly appreciated by the scientific world. A Patient of his labouring under Diabetes was found to discharge daily

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large quantities of Saccharine matter in his urine — On having him bled & testing the serum of the blood the presence of Sugar was distinctly exhibited. The experiment was repeated several times & with the same result. — From the facts related above I think myself justified in the conclusion that the disease is primarily seated in the Stomach, soon affecting the whole of the Chylopoietic viscera, & that it depends upon an imperfect assimilation of the aliment taken into that viscus. — The food is hereby rendered unfit for the purposes of Nutrition, & when taken up by the Lacteals & conveyed to the general circulation it is rejected by the nutrient powers of the system, & eliminated through the kidneys. The increased action of these organs is generated in the efforts of nature to free the vascular System of that afflux of fluid which is constantly pouring into it thro' the medium of the Lacteals. — I shall close this part of my subject by observing that the diseased appear-

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ance of the Kidneys is entirely owing to a Law of the animal Oeconomy termed Sympathy. By it their action is increased according to the exigences of the system, & being kept up for any length of time must necessarily produce more or less disease by the continued stimulus which it imparts. They have no agency I believe in the formation of the sugar incident to Diabetic urine, but merely serve to receive it already formed by the Stomach, & to throw it out of the System.

Part IId.

I come now to the second part of my subject, or the influence which the Prus: Potass when taken internally exerted on the Pulse & system in general – I shall relate the experiments in the order they were performed, making some few observations on each & afterwards such remarks as may naturally grow out of the general result

Exp.t 1st. I took one & a half grs of the Prus: Potass.

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in solution my pulse beating 72 strokes ⅌ minute – In 10 minutes after it beat 64 strokes – in

min:	15.	20.	25.	30.	35.	40.	45.	50.	55.	60.	65.	70
strokes	64.	62.	60.	60.	58.	62.	62.	64.	64.	64.	70.	72.

It will be observed that my pulse in the above experiment was suddenly reduced in frequency 10 strokes, & that it vibrated between 58 & 64 for the space of 40 minutes, & then gradually rose to 72 which was the standard at the commencement of the experiment. –

Expt 2d. I took a grain & a half in solution, pulse beating 82 strokes in a minute, in

Min	15.	20.	25.	30.	35	40.	45.	50.	55.	60.	65.	70.
strokes	80.	80.	75.	76.	74.	74.	74.	74.	72.	75.	75.	76.

By a reference to the last experiment it will be found that my pulse during the first 20 minutes was reduced only two strokes; it then suddenly fell from 80 to 75 being seven strokes less than at the beginning of the experiment. It remained diminished in frequency, volume & force from about 35 to 40 minutes & upwards. Why the operation of the article was not as evident in this experiment during the first 20 minutes as in the preceding may appear strange. In the first place my

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pulse was preternaturally frequent being 82 strokes p. minute at the beginning of the experiment. I presume that it was thus increased in frequency by something which I had either eaten or drank previous to the exhibition of the dose: or perhaps there was a slight degree of fever induced by the usual causes of such diseases; it being the season of the year when the system is always more or less impregnated with the seeds of Fever. If what I have said be the true cause of the preternatural state of my pulse, & I am disposed to think the position well founded, it may be readily explained why the medicine did not shew its effects more promptly. After being taken into the stomach it had to combat the increased excitement of the System, which would retard the development of its power more or less according to the degree of force. This appears to be the true solution of the problem, from the further circumstance of its producing an evident reduction of the pulse in the course of 25 or 30 minutes

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& continuing to do so for a considerable time afterwards.

Expt 3d. I took 3gr in Solution my pulse beating 76 strokes pr minute. In 10 minutes it beat 72 - In

min	15.	20.	25	30.	35.	40.	45	50.	55	60.	65	70
strokes	74.	64.	64.	64.	64.	66.	68.	68.	69.	72.	72.	72.

It will be seen in this experiment that my pulse was lessened in frequency at one time 12 strokes, that it continued vibrating between 64 & 66 for 20 minutes, & then very gradually rose. During the operation of the article, my pulse was very irregular in point of time between each vibration, accompanied with considerable oppression & a slight pain about my breast.

Expt 4th. I took 5gr of the article in Solution, my pulse beating 72 strokes pr minute - In 10 minutes after it beat 69 - In

min	15	20.	25.	40.	45.	50	55.	60.	65
strokes	69.	66.	69.	69.	66.	66.	63.	66.	62

70.	75.	80.	85	95	105.	115.	120
60.	60	59.	54	54	54	51.	54

In this experiment it will be observed that my pulse was not so suddenly reduced in frequency as in the preceding, but that its ultimate impression was much more powerful, both in diminishing the frequency of the pulse, & in the time of its

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duration. For the first 40 minutes my pulse was only reduced in frequency 3 strokes, in 20 minutes more it gradually fell to 62 being 10 strokes less than at the beginning of the experiment. At the expiration of 15 minutes more it will be found to have lessened 3 strokes – It now fell to 54 strokes pr minute & remained stationary for 35 minutes; excepting once during the process when it fell to 51 which was nearly two hours after the article was administered. I examined my pulse three hours afterwards & found it still lessened in frequency. During the last experiment I frequently felt an uneasiness in different parts of my head, my face was alternately flushed & very pale, considerable weakness of my eyes, & disposition to sleep, my mind somewhat dejected, with general debility & indisposition to move about. Towards the close of the experiment a considerable Diaphoresis appeared, & likewise twitching of the Tendons. – My

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pulse during the operation was very much dimin-
ished both in volume & force, & was marked by
considerable inequality in relation to the time of
its vibrations, with oppression at my breast. My
urine was increased in quantity, but a good deal
of difficulty attended its evacuation. – About
three or four hours after the article was taken
my bowels became affected & discharged liquid
stools ~~with~~ ~~that~~ with some degree of griping –

In reviewing the results of the preceding ex-
periments the first circumstance that attracts
our attention is the uniform effect of the arti-
cle in reducing the frequency of the pulse without,
in any instance, raising it above the natural
standard. It moreover exerted considerable influ-
ence on the volume & force, producing general de-
bility of the system, & rendering it disagreeable and
irksome to use any exertion either of body or
mind. A difficulty of breathing with tightness

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of a slight pain in the breast was particularly exemplified in the last experiment. There was during the same experiment considerable uneasiness of my head, at times amounting to pain with weakness of my eyes & a disposition to sleep. Towards the close a Diaphoresis was very distinct, appearing first in the forehead, breast, palms of the hands, & then gradually diffusing itself over the surface of the body. At this time all the disagreeable feelings above mentioned disappeared. Several hours after taking the last dose of the article when all the above symptoms had subsided I felt some degree of pain & griping in my bowels accompanied with a discharge of a liquid nature which afforded relief & restored them to a state of quiescence. About the same time my urine was increased beyond the natural quantity, but great difficulty was experienced in expelling it, the bladder having in some measure lost its energy. This circumstance was repeatedly

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observed, the inclination frequently occurred but the bladder was unable for several minutes to perform its function. This inability frequently continued for four & twenty hours. At no time during the whole series of my experiments was the slightest nausea, or any alteration in the State of the Stomach manifested — Although the generally received opinion of the present day respecting the primary operation of all medicines on the human System is, that they increase action, still I am compelled by the results arising from the preceding experiments to dissent from the application of this maxim to every article of a medicinal nature. I feel fully authorized in asserting that the <u>sensible</u> operation of the Prussi: Potass: on the System is that of a Sedative strictly so called. It uniformly lessened the frequency of the pulse without in any instance increasing it beyond the natural Standard —

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prove the same point beyond all manner of doubt. In order to remove every obstacle opposed to the utmost accuracy in the preceding experiments, I procured the favour of my friend and fellow Student Mr Wm P. Marshall of S. Carolina to examine the state of my pulse at different periods during the experiments, who I am well assured made use of all the care & precision which the nicety of the subject demanded.

It is ascertained by analysis in the hands of the most respectable Chymists that Prussic acid is a constituent of several of the narcotic articles of the Materia Medica. Finding it always present in those articles which have been examined by them, they have analogically concluded that it is a necessary part of the composition of all narcotics. From the effects exerted by the Pruss: Potass on the system resembling opium & other narcotics so closely, I am induced to credit the supposi=

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tion that the peculiar virtues of such articles are owing to the prussic acid they contain. If this notion be well founded the Prep: Potash: deserves to hold a higher rank than it has hitherto been allowed in the field of Practice. Not having used the article myself, nor seen it used by others, I am wholly unprepared to say any thing in relation to its efficacy. Judging however from its general effects I think it would be well adapted to those cases of increased excitement when depletion, having been pushed to a certain extent, is contra indicated by the debility which its further prosecution would endanger.

In its operation it resembles Opium so very closely that I am induced to think it might be advantageously exhibited in many diseases where that noble medicine is found efficacious. — Perhaps by administering this remedy we may procure the beneficial effects

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of Opium without its disadvantages, such as stupor, langour &c which almost always follow its exhibition. Though the article indeed produced general debility & a disposition to sleep during its duration, yet in a few hours all those disagreeable effects passed off, leaving me in every respect as well as before I had taken it.

From its acting so promptly in reducing excitement, I think it might operate as an efficacious remedy in Hæmorrhagies of the active kind. This however is entirely speculation having no facts to support it; nor is it likely that a trial will ever be made with it while other remedies exist of far less doubtful efficacy.

Notwithstanding the virtues of this substance in relation to the cure of diseases has not yet been ascertained, still from a survey of its general operation on the system, I think it by no means improbable that it will be found a highly

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valuable acquisition to the materia Medica, and thus at no distant date be clasped with those happy means we already enjoy of alleviating the maladies incident to our nature —

Before Gentlemen I close this very imperfect essay, I beg leave to tender my sincere acknowledgements for the information I have received from your lectures respectively, and may you long live to enjoy that fame & reputation which you have so justly acquired —